Physical Review B - Condensed Matter and Materials Physics 2011 vol.84 N8

Resonant tunnel magnetoresistance in double-barrier planar magnetic tunnel junctions

Useinov A., Kosel J., Useinov N., Tagirov L.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We present a theoretical approach to calculate the spin-dependent current and tunnel magnetoresistance (TMR) in a double-barrier magnetic tunnel junction (DMTJ), in which the magnetization of the middle ferromagnetic metal layer can be aligned parallel or antiparallel in relation to the fixed magnetizations of the left and right ferromagnetic electrodes. The electron transport through the DMTJ is considered as a three-dimensional problem, taking into account all transmitting electron trajectories as well as the spin-dependent momentum conservation law. The dependence of the transmission coefficient and spin-polarized currents on the applied voltage is derived as an exact solution to the quantum-mechanical problem for the spin-polarized transport. In the range of the developed physical model, the resonant tunneling, nonresonant tunneling, and enhanced spin filtering can be explained; the simulation results are in good agreement with experimental data. © 2011 American Physical Society.

http://dx.doi.org/10.1103/PhysRevB.84.085424